King County

Marine and Sediment Assessment Group 2012 Work Plan

The best decisions are based on Sound information.

Date: December 7, 2011

To: Recipients

From: Scott Mickelson and Kimberle Stark

Subject: Transmittal of the 2012 Work Plan for the Marine and Sediment Assessment Group

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This memorandum and attachments present the 2012 Work Plan for the Marine and Sediment Assessment Group of the King County Department of Natural Resources and Parks. The work plan includes both routine marine monitoring programs and Wastewater Treatment Division capital support projects such as the Brightwater marine outfall, Sediment Management Plan, and East Waterway and Lower Duwamish Waterway Superfund projects. Included with the memorandum are matrix tables that provide sampling locations, sampling frequency, and parameters measured for the 2012 routine monitoring programs, as well as maps showing sampling locations. Also included are summaries of projects in the proposal phase for 2012 and the Marine and Sediment Assessment Group's work accomplishments for 2011.

Station locations and analytical parameters may change from year to year. Any changes are based on an evaluation of previous years' data to determine if the data collected are meeting monitoring objectives for both the ambient and outfall monitoring programs and/or budgetary constraints. Marine and Sediment Assessment Group staff evaluate data each year to determine what changes are necessary, including what parameters should continue to be analyzed. A summary of how the marine monitoring program has changed over time, both in locations sampled and water quality constituents monitored, may be found on-line in the 2009 Work Plan at http://green.kingcounty.gov/marine/Reports/2009-Marine-Group-Work-Plan.pdf.

2012 Marine Offshore Water Column Monitoring Program

Water column samples will be collected monthly from 18 stations. Nine outfall monitoring stations are located at outfalls for the West Point, South, and Vashon treatment plants, the Alki and Carkeek combined sewer overflow (CSO) treatment plants, the Elliott West and Henderson/MLK/Norfolk CSO treatment facilities, the Barton Street CSO, and the Hanford CSO. Nine ambient monitoring stations are located at Point Wells, Point Jefferson, Elliott Bay, Fauntleroy/Vashon, East Passage, the Lower Duwamish Waterway (2 stations), and Quartermaster Harbor (two stations). It is anticipated that the Brightwater marine outfall will commence operation at some point in 2012. At this time, the Point Wells ambient station will henceforth be considered and outfall station.

Discrete water samples will be collected from between one and seven depths at each offshore station, depending on the total station depth. Conductivity, temperature, depth (CTD) profiles will be conducted throughout the entire water column at 15 of the 18 stations – those stations sampled from King County's research vessels *Liberty* or *Chinook*.

Laboratory analytes will include fecal coliform and enterococcus bacteria, chlorophyll-*a* and pheophytin pigments, suspended solids, and nutrients (ammonia, nitrite/nitrate nitrogen, orthophosphate and silica). Total nitrogen will be analyzed on a subset of nine samples. Bacteria samples will be collected from all sampling depths at each of the outfall monitoring stations but only from the surface at ambient monitoring stations, with the exception of the Quartermaster Harbor and Duwamish River samples. Bacteria samples will be collected from both depths at each Quartermaster Harbor and Duwamish River ambient station. All other laboratory parameters will be analyzed on samples collected from every depth.

Electronic *in situ* data will be collected at all but three offshore stations using a CTD sensor array. CTD data will include the following parameters; dissolved oxygen, salinity, temperature, density (calculated), transmissivity, photosynthetically active radiation (PAR), pH, and fluorescence (as a measure of chlorophyll). Surface PAR and Secchi depth measurements will also be collected at all of the offshore stations collected from the *Liberty* or *Chinook*. Secchi depth is collected as well at the two Quartermaster Harbor stations. Field measurements for dissolved oxygen and temperature will be collected using a Hydrolab® instrument at the two Quartermaster Harbor stations and the Henderson/MLK/Norfolk CSO station.

Marine Moorings

Marine moorings that include *in situ* water quality data gathering sensors are currently deployed at three locations – the Seattle Aquarium (two depths), Dockton Park (one depth), and the Quartermaster Harbor Yacht Club (one depth). A fourth system, which had been deployed at a location near the Alki CSO Treatment Plant outfall was removed in early December 2011, due to damage and inoperability.

These marine mooring systems gather data at 15-minute intervals for dissolved oxygen, salinity, temperature, fluorescence (chlorophyll), turbidity, and pH. Meteorological data are also collected by the mooring systems deployed at the Seattle Aquarium and Quartermaster Harbor Yacht Club. The buoy-mounted mooring system that was deployed at Alki also gathered nitrate nitrogen data. Options are currently under evaluation for future deployment of the sensors that were associated with the fourth mooring system.

Continuous data gathering involves a high degree of data management, quality control, and website maintenance to make the data available publicly. The marine mooring web page was redesigned in 2009 to facilitate better public access to the data and enhanced data analysis and reporting tools. The Marine and Sediment Assessment Group will continue to provide support for web maintenance, quality control, and data analysis.

2012 Marine Beach Water Quality Monitoring Program

Water samples will be collected monthly from 20 beach stations and 1 stream station. Nine outfall-vicinity monitoring stations are located inshore of the West Point (two stations) and Vashon treatment plant outfalls, the Alki (two stations), Carkeek, and Elliott West CSO treatment plant outfalls, and the Magnolia and Barton CSO outfalls.

All nine of the outfall-vicinity monitoring stations will be sampled monthly for analysis of fecal coliform and enterococcus bacteria, temperature, salinity, and nutrients (ammonia, nitrite/nitrate nitrogen, and orthophosphate). All 11 of the ambient beach stations will also be monitored for bacteria, temperature, nutrients, and salinity. The Piper's Creek stream station will be monitored for bacteria, temperature, and nutrients. A subset of six beach water samples will also be analyzed for Total Nitrogen.

2012 Subtidal Sediment Monitoring Program

King County restructured its ambient marine subtidal sediment monitoring program in 2007 to both supplement the Washington State Department of Ecology's sediment monitoring program and to provide focused monitoring of sediment quality in Elliott Bay. Subtidal sediments are collected every two years from eight stations in Elliott Bay and every five years from six additional stations outside of Elliott Bay, including three stations in the main basin of Puget Sound and three associated embayments. All 14 stations were first sampled in 2007 and the eight Elliott Bay stations were sampled again in 2009 and 2011.

In 2012, the three main basin and three embayment stations will be sampled. Sediment samples will be analyzed for conventional parameters (total solids, total organic carbon, particle size distribution, ammonia, sulfides), metals, and organics (semivolatile compounds, chlorinated pesticides, PCBs, and PDBEs (flame retardants). The original 2007 sampling and analysis plan will be updated and amended as warranted for the 2012 sampling event. Data generated from the ambient subtidal sediment monitoring program are used, in part, to provide information for the County's KingStat environmental indicators program.

Brightwater Marine Outfall Technical Support

The following Brightwater marine outfall project work will be undertaken during 2012:

- Preparation of the final report summarizing results of the pre-operation baseline sediment characterization at the outfall diffusers.
- Preparation of the final report summarizing results of the nearshore benthic surveys at the trench construction site.
- Consultant oversight and coordination for eelgrass survey activities and reports.
- Conducting one ROV survey of the eelgrass transplant areas in early summer.
- Development of an eelgrass project web page.
- Agency meetings and updates as necessary.

Denny Way/Lake Union CSO Control Project Sediment Monitoring Program

On-going sediment monitoring at this project site is being performed in accordance with the Biological Opinion issued for the project under the Endangered Species Act Section 7 consultation. Sediment monitoring is also being performed in support of NPDES permit requirements as well as the nearshore interim sediment cleanup project in Cleanup Areas A and B (completed in 2008) and the monitoring of natural recovery of sediment in Cleanup Areas C, D, and E. In 2012, sediment monitoring is only required for the cleanup areas. Therefore, sediment samples will be collected from only 7 of the 16 routine monitoring stations, with analysis performed only for sediment chemistry.

West Point, South, Brightwater, and Vashon Treatment Plants – NPDES Permit Work

New NPDES permits for the West Point and South treatment plants were issued in 2009 and new NPDES permits for the Brightwater and Vashon treatment plants were issued in 2011. The following work will be undertaken in 2012 in support of NPDES permit requirements:

- The third round of sampling for the NPDES receiving water characterization for the West Point, South, Brightwater, and Vashon Treatment Plants, and CSO treatment facilities will occur in July. This event will involve collection of samples for analysis of ultra-trace-level metals and conventional parameters.
- The fourth and final sampling event for the characterization will occur in December.

Sediment Management Plan – CSO Outfall Sediment Monitoring

Sediment samples were collected from 10 CSO outfall monitoring sites in 2011 and analyzed for conventional, metal, and organic parameters. Data from this sampling effort will be used to: 1) populate and calibrate the County's near-field sediment recontamination model; 2) determine if any exceedences of Washington State Sediment Management Standards chemical criteria exist at the 10 CSO outfall sites; and 3) create a pre-construction sediment quality baseline at four of the locations, for which CSO control projects are currently underway. Additional sediment sampling at a subset of the sites/stations will occur in 2012. Data from this sampling event will be used to verify model output from the near-field sediment recontamination model.

Data from the 2011 sampling event will also be summarized and presented in a technical memorandum to the Wastewater Treatment Division and the Department of Ecology.

Inter-Laboratory Nutrient Calibration Study

King County will continue to partner with the Washington State Department of Ecology on an inter-laboratory nutrient calibration study. The goals of the study are to:

- determine direct comparability of nutrient data currently collected and analyzed for central Puget Sound sites;
- provide a means to share data and utilize each agency's results collected for current and historical monitoring projects in Puget Sound;
- provide an understanding (degree, extent, and affected species) of similarities/differences of nutrient results provided by each agency to be used for a combined water quality index ass***e***ssment and trend analysis for Central Basin stations; and
- provide comparative data for evaluation of laboratory performance and methods, should a transition or need for utilization of another analytical lab arise for future monitoring/projects.

A second pilot study, similar to the one conducted in 2010, was performed in July of 2011. Standards, prepared by Ecology staff, were submitted to both the King County Environmental Laboratory and the University of Washington Oceanography Technical Services Laboratory for analysis of ammonia nitrogen, nitrate nitrogen, orthophosphorus, and silica. The pilot study was being repeated since Ecology staff discovered trace levels of ammonia nitrogen in their reagent water used to prepare standards during the original pilot study.

Based on results of both pilot studies, the following work will be undertaken in 2012, in support of this ongoing inter-laboratory calibration effort:

- Sample splits will be collected by field scientists from both King County and Ecology during their respective marine water column sampling runs in January and August. These sample splits will be analyzed by both the King County Environmental Laboratory and the University of Washington Oceanography Technical Services Laboratory. These samples will be analyzed for ammonia nitrogen, nitrate/nitrite nitrogen, orthophosphate, and silica.
- Once during 2012 (to be determined), standards for all four nutrients will be submitted to both laboratories in a range of concentrations similar to the previous pilot studies, to be analyzed as a continuing inter-laboratory calibration check.
- Staff of King County and Ecology will prepare a technical memorandum summarizing a precision and accuracy analysis of the data resulting from the first two pilot studies and the 2012 continuing calibration check.

Delivery of samples to the University of Washington will be coordinated between agency staff. King County and the University of Washington laboratories will follow their standard protocols for analysis of nutrients.

Miscellaneous 2012 Work Items

- Completion of Phase II of the Marine Monitoring web page, including uploading historical data and creation of web reporting tools.
- Completion of a new, web-based, marine water quality monitoring reporting system, beginning with the 2008 and 2009 data reports.
- Performance measure and environmental indicator updates.
- Preparation of sections for the RWSP Update report.
- Data validation for the Lower Duwamish Waterway and East Waterway Superfund projects.
- Preparation of the 2013 marine and sediment assessment group work plan.
- Preparation of the 2011 Scientific Collection Permit report.
- Phytoplankton sampling (along with water quality parameters) will continue at three existing marine water column stations, twice a month, from April through October. Due to the extended phytoplankton bloom season in Quartermaster Harbor, sampling will be expanded to include sampling in March and November at this site, resources permitting.
- Technical support for the EPA Quartermaster Harbor Nitrogen Study grant.
- Technical support for the Wastewater Treatment Division's Sediment Management Plan.
- Technical support for the Puget Sound Partnership.
- Data downloading and analysis for outside agencies, educational facilities, private entities, and the general public;
- Preparation of talks and/or posters and participation in the Pacific Estuarine Research Society's 2012 annual meeting.

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King County Marine and Sediment Assessment Group – 2011 List of Accomplishments

The following work items were accomplished by staff of the King County Marine and Sediment Assessment Group during 2011.

Ambient and Outfall Monitoring Programs

- Coordinated and implemented the collection of marine water, sediment, and phytoplankton samples for both the ambient and outfall monitoring programs.
- Acted as the liaison between the Science Section and Environmental Laboratory to facilitate communication and project success.
- Completed internal programmatic annual review.
- Updated the KingStat marine environmental indicators.
- Provided sections for the annual RWSP update report.
- Completed a major update to the marine photos webpage (pending completion by web application development staff).
- Completed analysis and quality control of 2008 and 2009 marine data, including mooring data.
- Completed several of the data summaries for the new annual reporting format on the marine group webpage.
- Coordinated and co-chaired a session on integrating automated ocean observing systems with traditional water quality monitoring at the 2011 Coastal and Estuarine Research Federation conference.
- Completed a draft report for the 2008 through 2010 marine phytoplankton data.
- Reviewed and submitted comments to Ecology for the Washington State water quality assessment and 303(d) list.
- Acted as the Science project representative to the Environmental Laboratory to assist with the development of a web-based tool for uploading LIMS data to Ecology's EIM database.

NPDES Permit-Related Work

- Completed sampling and analysis for the West Point 2011 sediment quality characterization, including the first phase of the sediment toxicity identification evaluation (TIE) process. Data were submitted to Ecology's EIM database and a technical memorandum was submitted to the County's NPDES permit coordinator in fulfillment of one requirement of the West Point NPDES permit.
- Completed sampling and analysis for the South Plant 2011 sediment quality characterization. Data were submitted to Ecology's EIM database and a technical memorandum was submitted to the County's NPDES permit coordinator in fulfillment of one requirements of the South Plant NPDES permit.
- Completed the first two rounds of sampling for the NPDES receiving water characterization study, in fulfillment of one requirement of the West Point, South Plant, Brightwater, and Vashon NPDES permits.

Brightwater Marine Outfall

- Completed the third post-construction eelgrass SCUBA diver survey and data report. The eelgrass plants did well in 2011 and we now have approximately 22,000 shoots from an initial planting of between 10,000 and 16,000 shoots!
- Completed the final baseline sediment characterization study sampling event at the outfall diffuser site.
- Completed the final nearshore benthic community study sampling event at the trench site.

- Completed one underwater video ROV surveys at the eelgrass transplant site (with the ESS ROV team). The ROV team also collected great video footage of how the outfall pipes are providing habitat for various marine organisms.
- Sent all 2011 eelgrass reports to agency representatives per permit requirements.
- Hosted a marine outfall scientific study display booth at the grand opening of the Brightwater Treatment Facility in September 2011.
- Completed the final report for the Intertidal Biota project.

Lower Duwamish Waterway and East Waterway Superfund Projects

- Completed five major data validation efforts for the CSO effluent characterization study and Hanford/Lander source tracing study (in-line sediments).
- Co-authored the CSO effluent characterization report, which will be used both for the CSO control program and the Lower Duwamish Water and East Waterway Superfund projects.

Miscellaneous Project Work

- Provided support for the EPA Quartermaster Harbor Nutrient Management Study grant.
- Designed and prepared a SAP for a reduced-scope sediment characterization study at the Denny Way CSO outfall.
- Designed a major sediment characterization study at 10 CSO outfalls and prepared a SAP. Sampling was completed in 2011 as well. Data from the study will be used to populate, calibrate, and verify the County's near-field sediment recontamination model and provide pre-construction sediment quality data at four CSOs, for which CSO control projects are currently underway.
- Completed major data requests for internal clients, outside agencies, educational institutions, consultants, and the general public.
- Participated in regional monitoring groups associated with the Puget Sound Partnership, such as the Nearshore Monitoring Subgroup, the Water Quality Working Group, and the Washington State BEACH Program.

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The attachments that accompany this work plan include:

- A color-coded map showing the locations of all 2012 routine marine monitoring stations and marine moorings.
- A table of all routine marine monitoring sampling locations with stratum sampled (stream, beach, offshore), matrices monitored, and station coordinates.
- Matrix tables showing outfall and ambient stations and the sampling regime for each.
- Maps and analytical matrix tables for each of the four routine marine monitoring programs for 2011 – offshore water column, beach water, and subtidal sediment.

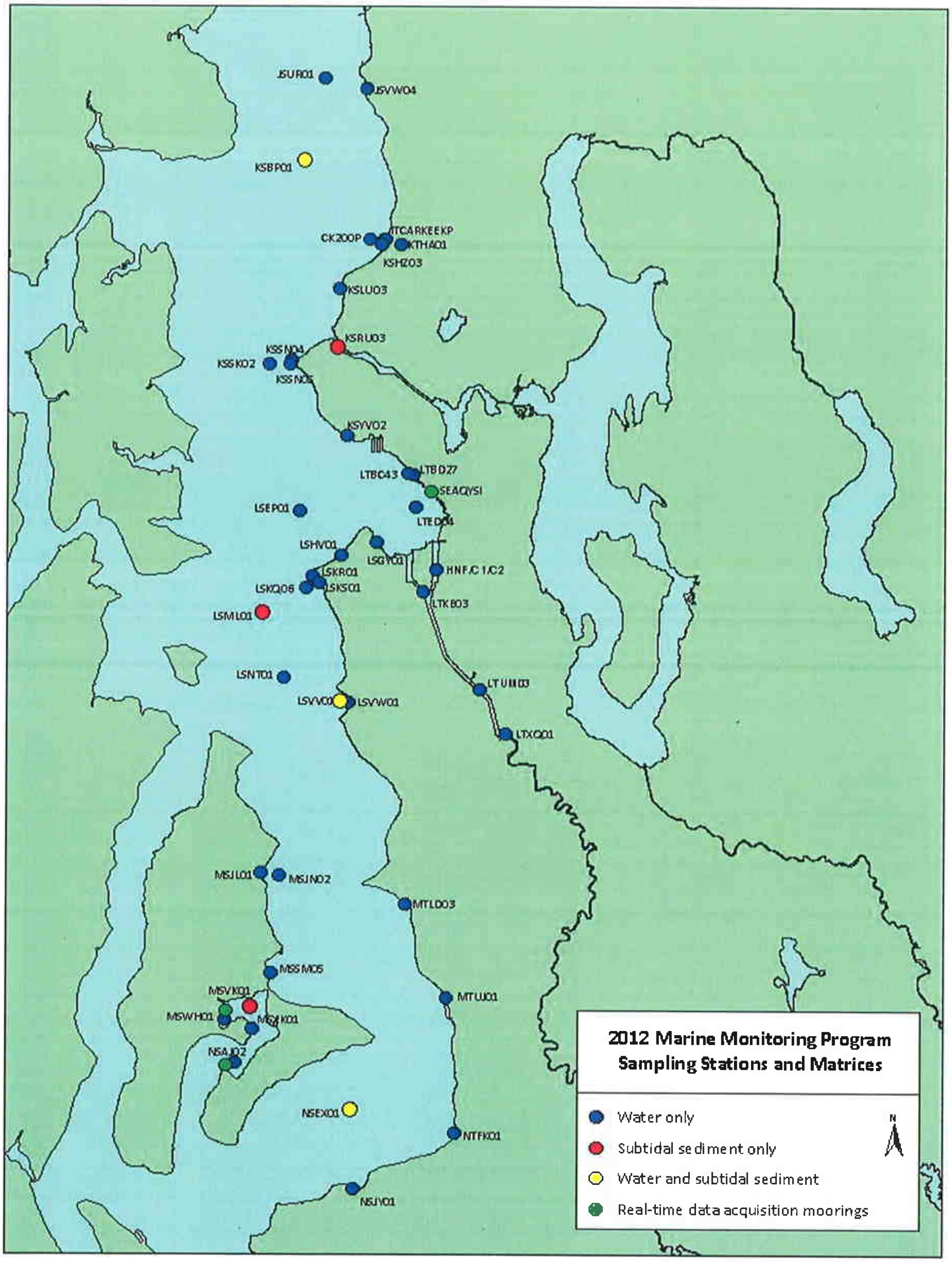
Marine and Sediment Assessment Program
2012 Ambient Stations, Laboratory Parameters, and Frequency Measured

Station	Location	Stratum	Number of Depths for Water Samples	Water		Sediment			Budget Information		
				Bacteria[1]	Conventionals	Conventionals	Metals	Organics	Program	Customer	Funding Source
JSUR01	Brightwater	Offshore	7	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
KSBP01	Jefferson Head	Offshore	7	◆ 12	◆ 12	◆ 1	◆ 1	◆ 1	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTKE03	Duwamish River	Offshore	2	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTUM03	Duwamish River	Offshore	2	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSNT01	Fauntleroy/Vashon	Offshore	7	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NSEX01	East Passage	Offshore	7	◆ 12	◆ 12	◆ 1	◆ 1	◆ 1	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MSWH01	Quartermaster Harbor	Offshore	2	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NSAJ02	Quartermaster Harbor	Offshore	2	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LTED04	Elliott Bay	Offshore	6	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSML01	West Seattle	Offshore	--			◆ 1	◆ 1	◆ 1	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
KSRU03	Outer Salmon Bay	Offshore	--			◆ 1	◆ 1	◆ 1	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MSVK01	Quartermaster Harbor	Offshore	--			◆ 1	◆ 1	◆ 1	Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
JSVW04	Richmond Beach	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
ITCARKEEKP	Carkeek Park	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
KTHA01	Piper's Creek	Stream	1	◆ 12	◆ 12				Ambient/PSAMP	WTD	WTD Operating
KSLU03	Golden Gardens	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSGY01	Seacrest	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
LSHV01	Alki Beach	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MTLD03	Normandy Park	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MTUJ01	Des Moines Pk.	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NTFK01	Redondo Beach	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
NSJY01	Dumas Bay	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MSXK01	Burton Acres	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
MSSM05	Tramp Harbor	Beach	1	◆ 12	◆ 12				Ambient/PSAMP	WTD/PSP/Kstat/Ecol.	WTD Operating
		Total Samples for 2012		**300**	**648**	**5**	**5**	**5**			
		Total Samples on a Monthly Basis		**25**	**54**	**5**	**5**	**5**			

[1]Bacteria samples collected only at the surface for offshore stations, with the exception of the two Duwamish River and two Quartermaster Harbor stations.

Marine and Sediment Assessment Program
2012 Outfall Stations, Laboratory Parameters, and Frequency Measured

				Water			Sediment			Budget Information		
Station	Location	Stratum	Number of Depths for Water Samples	Bacteria	Metals	Conventionals	Conventionals	Metals	Organics	Program	Customer	Funding Source
CK200P	Carkeek Outfall	Offshore	5	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSSK02	West Point Outfall	Offshore	5	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LTBC43	Denny Way Outfall	Offshore	2	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSEP01	Renton Outfall	Offshore	7	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSKQ06	Alki Outfall	Offshore	4	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
MSJN02	Vashon Outfall	Offshore	5	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol./WaDNR	WTD Operating
LSVV01	Barton CSO Outfall	Offshore	2	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LTXQ01	Hend/MLK/Nfk Outfall	Offshore	1	◆ 12	◆ 12	◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
HNF/C1&2	Hanford/Lander CSOs	Offshore	2	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSHZ03	Carkeek Park	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSSN04	West Point North	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSSN05	West Point South	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
KSYV02	Magnolia CSO	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LTBD27	Sculpture Park	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSKR01	Alki North	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSKS01	Richey Viewpoint	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
LSVW01	Fauntleroy Cove	Beach	1	◆ 12		◆ 12	◆ 1	◆ 1	◆ 1	Outfall Mon.	WTD/PSP/Kstat/Ecol.	WTD Operating
MSJL01	Vashon Island	Beach	1	◆ 12		◆ 12				Outfall Mon.	WTD/PSP/Kstat/Ecol./WaDNR	WTD Operating
		Total Samples for 2012		**504**	**12**	**504**	**1**	**1**	**1**			
		Total Samples on a Monthly Basis		**42**	**1**	**42**	**1**	**1**	**1**			

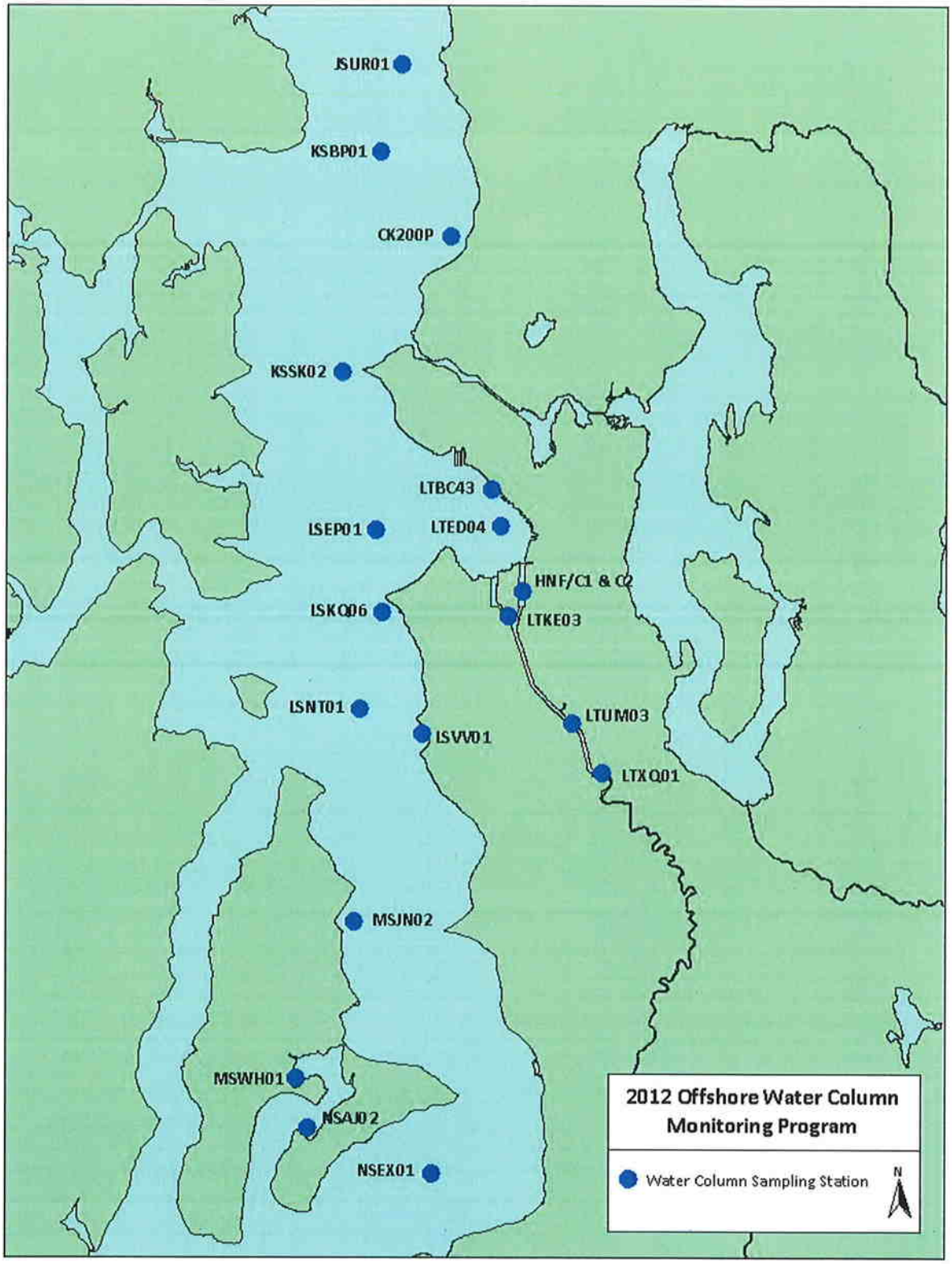

2012 Marine Monitoring Program
Sampling Stations and Matrices
Water only
Subtidal sediment only
Water and subtidal sediment
Real-time data acquisition moorings
N
JSUR01
JSVW04
KSBP01
CK200P
KTHA01
KSHZ03
KSLU03
KSRU03
KSSK02
KSYV02
LTBC43
LTBD27
SEAQYSI
LSEP01
LSHV01
LSKR01
LSKQ06
LSKS01
HNF/C 1/C2
LTKB03
LSML01
LSNT01
LSVW01
LTUM03
LTXQ01
MSJL01
MSJN02
MTLD03
MSSM05
MTUJ01
MSVK01
MSWH01
NSEX01
NTFK01
NSJY01

2012 Routine Marine Monitoring Program

Sampling Stations, Matrices Sampled, and Station Coordinates

Locator	Description	Stratum	Matrices	Northing[1]	Easting[1]
ITCARKEEKP	Carkeek Park	Beach	Water	263756	1259915
JSVW04	Richmond Beach/Point Wells	Beach	Water	286171	1257194
KSHZ03	Piper's Creek Mouth	Beach	Water	263736	1259784
KSLU03	Golden Gardens	Beach	Water	256354	1253305
KSSN04	West Point North	Beach	Water	245729	1246032
KSSN05	West Point South	Beach	Water	245272	1245980
KSYV02	Magnolia CSO	Beach	Water	234547	1254488
LSGY01	Seacrest Park	Beach	Water	218711	1258776
LSHV01	Alki Beach	Beach	Water	216852	1253532
LSKR01	Alki North	Beach	Water	213666	1249416
LSKS01	Richey Viewpoint	Beach	Water	222222	1212121
LSVW01	Fauntleroy Cove	Beach	Water	194969	1254846
LTBD27	SAM Sculpture Park	Beach	Water	228851	1264297
MSJL01	Vashon Island - Gorsuch Creek	Beach	Water	169666	1241897
MSSM05	Tramp Harbor	Beach	Water	154908	1243459
MSXK01	Burton Acres Park	Beach	Water	146481	1240772
MTLD03	Normandy Park	Beach	Water	165142	1263285
MTUJ01	Des Moines Creek Park	Beach	Water	151129	1269533
NSJY01	Dumas Bay Park	Beach	Water	122831	1255835
NTFK01	Redondo Beach	Beach	Water	131067	1270899
CK200P	Carkeek CSO TP Outfall	Offshore	Water	263819	1257728
HNF/C1/C2	East Waterway	Offshore	Water	214139	1267488
JSUR01	Point Wells	Offshore	Water	287580	1250910
KSBP01	Jefferson Head	Offshore	Water/Sediment	275439	1248062
KSRU03	Outer Salmon Bay	Offshore	Sediment	247607	1253037
KSSK02	West Point TP Outfall	Offshore	Water	245121	1242740
LSEP01	South TP Outfall	Offshore	Water	223360	1247399
LSKQ06	Alki CSO TP Outfall	Offshore	Water	212065	1248334
LSML01	Central Basin/West Seattle	Offshore	Sediment	209645	1242954
LSNT01	Fauntleroy/Vashon	Offshore	Water	198653	1245194
LSVV01	Barton CSO Outfall	Offshore	Water/Sediment	195347	1253935
LTBC43	Elliott West CSO TP Outfall	Offshore	Water	228985	1263430
LTED04	Elliott Bay	Offshore	Water	223909	1264675
LTKE03	Duwamish River	Offshore	Water	211418	1265871
LTUM03	Duwamish River	Offshore	Water	196629	1274591
LTXQ01	Norfolk CSO Outfall	Offshore	Water	190313	1278053
MSJN02	Vashon TP Outfall	Offshore	Water	169328	1244585
MSVK01	Inner Quartermaster Harbor	Offshore	Sediment	149555	1239632
MSWH01	Quartermaster Harbor	Offshore	Water/Marine Mooring	147976	1236667
NSAJ02	Quartermaster Harbor	Offshore	Water/Marine Mooring	140223	1239011
NSEX01	East Passage	Offshore	Water/Sediment	134701	1255331
SEAQYSI	Seattle Aquarium	Offshore	Marine Mooring	225168	1267840
KTHA01	Piper's Creek	Stream	Water	262962	1262305

[1]North American Datum 1983 (NAD83) - State Plane Coordinate System - Washington North 4601

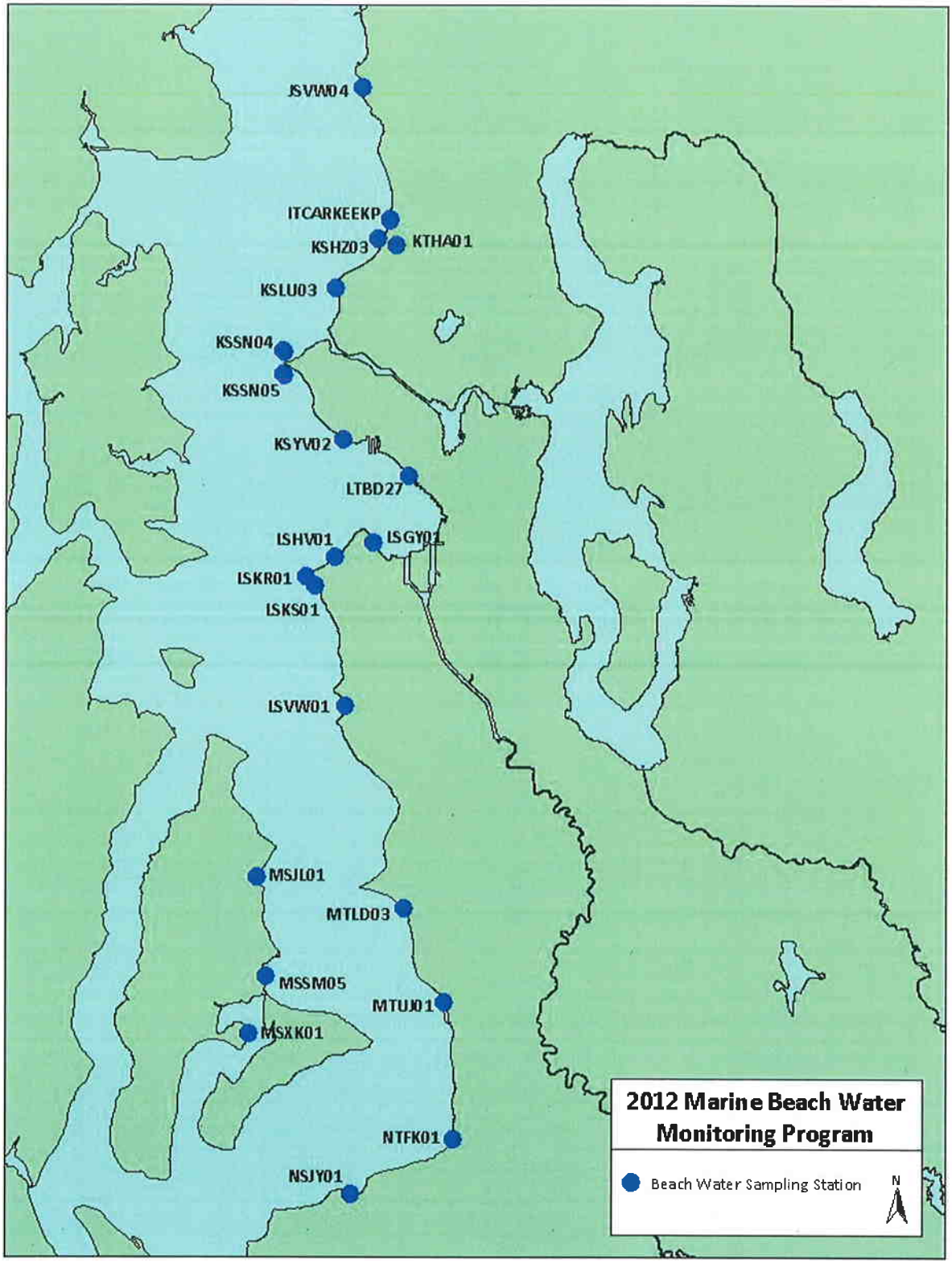

JSUR01
KSBP01
CK200P
KSSK02
LTBC43
LSEP01
LTED04
HNF/C1 & C2
LSKQ06
LTKE03
LSNT01
LTUM03
LSVV01
LTXQ01
MSJN02
MSWH01
NSAJ02
NSEX01
2012 Offshore Water Column Monitoring Program
Water Column Sampling Station
N

2012 Marine Offshore Monitoring Program

Monthly Ambient and Outfall Water Column Sampling
Laboratory and Field Parameters

		Bacteria		Conventionals & Metals													CTD									Field		
Station	Depth (m)	Enterococcus	Fecal Coliform	Ammonia Nitrogen	Chlorophyll-a	Dissolved Organic Carbon	Dissolved Oxygen - Winkler	Hardness by ICP	Nitrite + Nitrate Nitrogen	Phaeophytin	Salinity	Silica	Total Nitrogen	Total Organic Carbon	Orthophosphate	Total Suspended Solids	Chlorophyll, Field	Density, Field	Dissolved Oxygen, Field	Light Intensity (PAR), Field	Salinity, Field	Sample Temperature, Field	Surface Light Intensity (PAR), Field	Transmissivity, Field	Dissolved Oxygen, Field	Sample Depth	Sample Start Time	Secchi Transparency
JSUR01	1	1	1	1	1				1	1		1	1		1	1	1	1	1	1	1	1	1	1		1	1	1
	15			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	100			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	175			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
KSBP01	1	1	1	1	1				1	1		1	1		1	1	1	1	1	1	1	1	1	1		1	1	1
	15			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	100			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	200			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
CK200P	1	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	1
	15	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55	1	1	1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
KSSK02	1	1	1	1	1				1	1		1	1		1	1	1	1	1	1	1	1	1	1		1	1	1
	15	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55	1	1	1					1			1	1		1	1	1	1	1	1	1	1	1	1		1	1	
LTBC43	1	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	1
	15	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
LTED04	1	1	1	1	1				1	1		1	1		1	1	1	1	1	1	1	1	1	1		1	1	1
	15			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	75			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
LTKE03	1	1	1	1		1	1		1		1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1
	variable[1]	1	1	1		1	1		1		1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	
LTUM03	1	1	1	1		1	1		1		1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1
	variable[1]	1	1	1		1	1		1		1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	
HNF/C1	1	1	1	1		1	1		1		1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1
HNF/C2	variable[1]	1	1	1		1	1		1		1	1		1	1	1	1	1	1	1	1	1	1	1		1	1	
LTXQ01	1	1	1	1				1	1		1				1	1									1	1	1	
LSEP01	1	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	1
	15	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55	1	1	1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	100	1	1	1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	180	1	1	1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
LSKQ06	1	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	1
	15	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
LSNT01	1	1	1	1	1				1	1		1	1		1	1	1	1	1	1	1	1	1	1		1	1	1
	15			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	100			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	180			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
LSVV01	1	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	1
	5	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
MSJN02	1	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	1
	15	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35	1	1	1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55	1	1	1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
MSWH01	1	1	1	1	1				1	1	1	1			1	1									1	1	1	1
	variable[1]	1	1	1	1				1	1	1	1			1	1									1	1	1	
NSAJ02	1	1	1	1	1				1	1	1	1			1	1									1	1	1	1
	variable[1]	1	1	1	1				1	1	1	1			1	1									1	1	1	
NSEX01	1	1	1	1	1				1	1		1	1		1	1	1	1	1	1	1	1	1	1		1	1	1
	15			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	25			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	35			1	1				1	1		1			1	1	1	1	1	1	1	1	1	1		1	1	
	55			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	100			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
	170			1					1			1			1	1	1	1	1	1	1	1	1	1		1	1	
Total Samples/Records per Month		**46**	**46**	**75**	**48**	**6**	**6**	**1**	**75**	**48**	**11**	**74**	**7**	**6**	**75**	**75**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**70**	**5**	**75**	**75**	**17**
Total Samples/Records for 2012		**552**	**552**	**900**	**576**	**72**	**72**	**12**	**900**	**576**	**132**	**888**	**84**	**72**	**900**	**900**	**840**	**840**	**840**	**840**	**840**	**840**	**840**	**840**	**60**	**900**	**900**	**204**

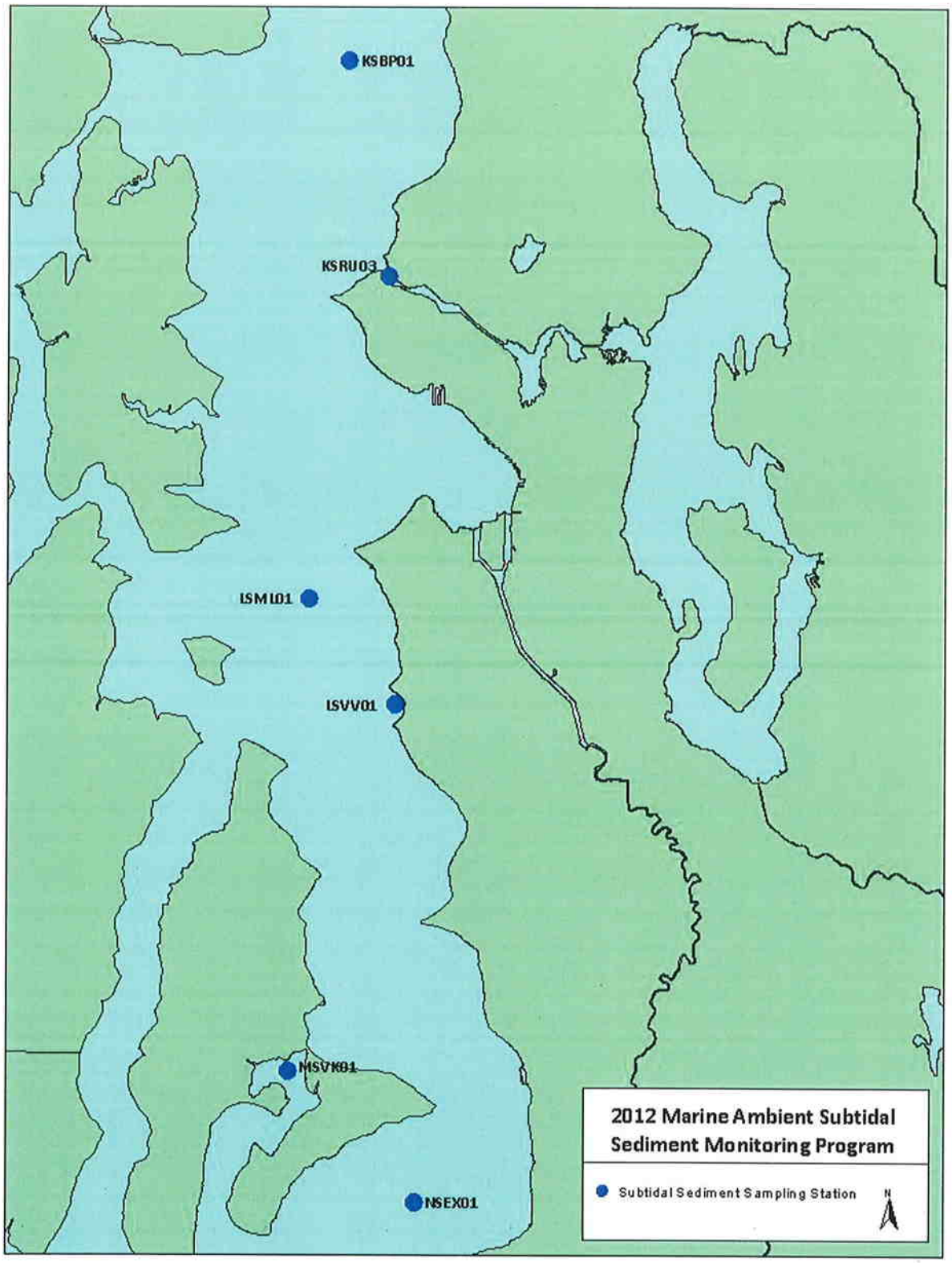
Variable[1] - Sample collected one meter abovef the bottom (depth variable with tidal height).


JSVW04
ITCARKEEKP
KSHZ03
KTHA01
KSLU03
KSSN04
KSSN05
KSYV02
LTBD27
LSHV01
LSGY01
LSKR01
LSKS01
LSVW01
MSJL01
MTLD03
MSSM05
MTUJ01
MSXK01
NTFK01
NSJY01
2012 Marine Beach Water Monitoring Program
Beach Water Sampling Station
N

2012 Marine Beaches Monitoring Program

Monthly Water Quality Sampling

		Bacteria		Conventionals					Field		
Locator	Station Description	Enterococcus	Fecal Coliform	Ammonia Nitrogen	Nitrite + Nitrate Nitrogen	Salinity	Total Nitrogen	Orthophosphate	Sample Start Time	Sampling Method	Sample Temperature, Field
JSVW04	Richmond Beach	1	1	1	1	1	1	1	1	1	1
ITCARKEEKP	Carkeek Park - North	1	1	1	1	1		1	1	1	1
KSHZ03	Carkeek Park - Piper's Creek Mouth	1	1	1	1	1	1	1	1	1	1
KTHA01	Carkeek Park - Piper's Creek Upstream	1	1	1	1			1	1	1	1
KSLU03	Golden Gardens	1	1	1	1	1		1	1	1	1
KSSN04	West Point - North	1	1	1	1	1		1	1	1	1
KSSN05	West Point - South	1	1	1	1	1		1	1	1	1
KSYV02	Magnolia CSO	1	1	1	1	1		1	1	1	1
LTBD27	SAM Sculpture Park Beach	1	1	1	1	1		1	1	1	1
LSGY01	Seacrest Park	1	1	1	1	1		1	1	1	1
LSHV01	Alki Beach	1	1	1	1	1		1	1	1	1
LSKR01	Alki Beach - Alki Plant North	1	1	1	1	1		1	1	1	1
LSKS01	Richey Viewpoint	1	1	1	1	1		1	1	1	1
LSVW01	Fauntleroy Cove	1	1	1	1	1	1	1	1	1	1
MTLD03	Normandy Park	1	1	1	1	1		1	1	1	1
MTUJ01	Des Moines Creek Park	1	1	1	1	1		1	1	1	1
NTFK01	Redondo Beach	1	1	1	1	1	1	1	1	1	1
NSJY01	Dumas Bay Park	1	1	1	1	1	1	1	1	1	1
MSJL01	Vashon Island - Gorsuch Road	1	1	1	1	1		1	1	1	1
MSSM05	Vashon Island - Tramp Harbor	1	1	1	1	1		1	1	1	1
MSXK01	Vashon Island - Burton Acres Park	1	1	1	1	1	1	1	1	1	1
	Total Samples/Records per Month	**21**	**21**	**21**	**21**	**20**	**6**	**21**	**21**	**21**	**21**
	Total Samples/Records for 2012	**252**	**252**	**252**	**252**	**240**	**72**	**252**	**252**	**252**	**252**


KSBP01
KSRU03
LSML01
LSVV01
MSVK01
NSEX01
2012 Marine Ambient Subtidal Sediment Monitoring Program
Subtidal Sediment Sampling Station
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2012 Marine Offshore Program
Ambient Subtidal Sediments
Laboratory and Field Parameters

		Laboratory										Field						
Locator	Station Description	BNAs (incl. Total Nonylphenols)	Chlorinated Pest/PCBs	PBDEs	Butyltin Isomers	Total Metals	Total Solids	Total Organic Carbon	PSD	Ammonia	Total Sulfide	Sample Start Time	Sample Depth	Sediment Sampling Depth	Sediment Sampling Range	SampcoordX	SampcoordY	Sediment Description
KSBP01	Central Basin - Point Jefferson	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LSML01	Central Basin - West Seattle	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
NSEX01	Central Basin - East Passage	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
KSRU03	Outer Salmon Bay	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
LSVV01	Fauntleroy Cove	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
MSVK01	Inner Quartermaster Harbor	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Total Samples/Records	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**	**6**

Notes

Samples will be collected from the 0 to 2 cm depth stratum.
Samples will be composited from a single deployment of dual van Veen grab samplers, unless additional deployments are needed to get sufficient sediment for all analyses.
Metals will include Al, As, Cd, Cr, Cu, Fe, Pb, Hg, Ni, Se, Ag, Sn, and Zn.
All analyses will be performed following QA1 guidance.
A new SAP will be prepared for this sampling event.